MALMSTROM AIR FORCE BASE, 564TH MISSILE SQUADRON,
PAPA MISSILE ALERT FACILITY
Approximately 3.1 miles east of I-15 and 2 miles north of SR 218
Conrad vicinity
Pondera County
Montana

HAER MT-138-A
HAER MT-138-A

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
INTERMOUNTAIN REGIONAL OFFICE
National Park Service
U.S. Department of the Interior
12795 West Alameda Parkway
Denver, CO 80228

HISTORIC AMERICAN ENGINEERING RECORD

MALMSTROM AIR FORCE BASE, 564th MISSILE SQUADRON
PAPA MISSILE ALERT FACILITY

HAER NO. MT-138-A

Location: Approximately 3.1 miles east of I-15 near Conrad, Montana and 2 miles north of State Route 218 in the South ½ of Section 6, Township 28 North, Range 2 West.

UTM: Zone 12/ 432517 Easting / 5339501 Northing

County: Pondera County, Montana

Date of Construction: Constructed as a Minuteman II system in 1965-1966; converted to a Minuteman III system in 1975

Architect: Ralph M. ParsonsCompany

Builder: Morrison Knudsen Company and Associates

Present Owner: Malmstrom Air Force Base (MAFB), US Air Force (USAF)

Present Use: Deactivated Minuteman III Missile Alert Facilities (MAF)

Significance: The Papa Missile Alert Facility is one of five MAFs associated with the 564th, an Intercontinental Ballistic Missile (ICBM) squadron based at Malmstrom Air Force Base, Montana. An MAF houses the personnel and equipment required to remotely monitor, control and command operations of a group of 10 Minuteman missiles. Each missile is deployed in its own unmanned below-ground silo known as a Launch Facility (LF). An MAF's ten missiles surround it with each LF located at least 3 miles from the MAF.

The Papa and the 564th Missile Squadron's (MS) four other MAFs were determined representative examples of the infrastructure and unique technological system developed in response to the nation's Cold War defense and strategic deterrence needs. As such, they are historically significant for their association with the late twentieth-century defense policy of the United States. Military leaders found the rural Montana countryside surrounding Malmstrom Air Force ideally suited the needs of the Minuteman program, being situated within striking range of the Soviet Union. Of greater importance was the region's low population density which meant comparatively minimal loss of life in the event of nuclear attack.

Additionally, the Papa and the 564th MS's four other MAFs embody some key aspects defining the Minuteman's technological superiority over its ICBM predecessors. Among the most significant of those was the consolidation of monitoring, control and command operations for a group of 10 missiles at a single central command facility. A two-person crew sat locked on constant 24-7 duty in the MAF's small and cramped underground portion which contained the controls and equipped for initiating missile launch. On Presidential command, each of the two crew members inserted a launch key which signaled crews at other MAFs to insert their launch keys. Actual missile launch could occur within less than one minute.

The Papa and 564th MS's four other MAFs are also significant as representations of the architectural evolution of the MAF. Although of blast-resistant hard construction, the underground control and command portion of the Minuteman I MAF was still highly-vulnerable to the severe ground tremors associated with the spread of nuclear radiation, while life support facilities were concentrated in the soft or non-blast resistant portion of the structure only. Minuteman II designers addressed the need for better survivability of personnel and equipment by upgrading the MAF's hard underground portion with life support facilities as well as shock absorbing devices to maintain the structure steady if hit by nuclear tremors. The new MAF was expected to sustain a livable environment for two weeks after attack. Conversion of a Minuteman II MAF to a Minuteman III retained these improvements.

Introduction

The 564th Missile Squadron's Papa MAF is located in the isolated rural countryside of north-central Montana. It houses the personnel and equipment required to control and continually monitor the operational and security status of its associated 10 unmanned LFs and missiles. An MAF could direct missile launch at a moments notice, but only upon appropriate higher command. The Papa MAF is encircled by its 10 LF, with each LF between 3 to 7 miles from it.

The Papa MAF occupies about 2 acres east of the small town of Conrad, Pondera County. Interstate Highway 15 runs about 3.1 miles west of the Papa MAF site and State Route 218 is about 2 miles south. An access road links the site to the state route. Open plains and farmland characterize the surrounding landscape, and few neighboring buildings are readily apparent from the facility.

The USAF named and numbered its Minuteman installations in a specific way. Facility names, such as Papa, came alphabetically, so the 564th MS, being the youngest squadron in the 341st MW, were named with the letters P, Q, R, S, and T. The MAFs were all numbered 0, while the LFs were numbered in increments of ten. Under this naming scheme, the Papa MAF is referred to as P-0 while the ten associated Papa LFs are P-1 through P-10. The 564th MS's other four facilities are: the Quebec with MAF Q-O and LFs Q-11 to Q-20; Romeo with MAF R-0 and LFs R-21 to R-30; Sierra with MAF S-0 and LFs S-31 to 40; and the Tango with MAF T-0 and LFs T-41 to T-50.

Papa and the 564th MS's other three missile fields initially were Minuteman II facilities, all constructed in 1965-1966. The Ralph A. Parsons Company of Los Angeles, California was the project architect and the Morrison Knudsen Company and Associates the construction contractor. The USAF converted all four 564th MS fields -- including the Papa -- from Minuteman II to Minuteman III facilities in 1975.

Evolution of MAF Technologies and Infrastructure

The question of how to store and launch an ICBM was problematic from its initial development and consequently, launch facilities went through several evolutions prior to the development of the Minuteman missile. The Atlas missile provided early experience with storing and launching a land-based missile prior to the 1960s. The Atlas had four types of launch facilities developed as the missile was upgraded: launch from a vertical above-ground launcher; horizontal storage in a warehouse that had a retractable roof; storage in a concrete building (called a coffin) which was then vertically raised before launch; and finally vertical storage in an underground silo before the missile was ultimately raised to the surface for launch. Although this final scheme allowed for fuel to be loaded within the missile during storage, highly volatile liquid oxygen still had to be added prior to launch, which made the system somewhat time-intensive.

The Titan missile launch facilities initially duplicated the Atlas pattern. The Titan missile was also stored vertically underground, fueled just prior to launch while still in the silo,

and then raised to the surface for an above ground launch. However, as the Titan missile evolved, its launch facility did as well, and by the time the final Titan missile was developed, the USAF had developed the capability to store and launch a missile from its launch facility by storing the missile and its fuel propellants together in the silo. While this made the Titan more efficient than its predecessors, the LF required constant care and attention. A full-time crew remained on-site to monitor the Titan missile site, making it an inefficient system both financially and technologically.

Development of the Minuteman system which allowed storage of missiles already fueled and ready for immediate launch proved a major advancement in the nation's ICBM program. The below ground storage and above ground launch design moved to a design that had every element of the missile below ground; including storage, fueling, repair, and launch. The entire span of time from launch to arrival at its target took half the time of the Atlas and Titan fueling process alone. Improvement of the missile itself and its storage and launch technologies made the Minuteman one of the most efficient missiles of its time. The entire span of time from launch to arrival at its target took half the time of the Atlas and Titan fueling process alone.

Another important component of the Minuteman program centered on the fact that a perpetual on-site crew was no longer needed at the launch facility. A Minuteman missile did not have the 300,000 parts of the Atlas and Titan missiles which significantly reduced maintenance and repair requirements, and made them less sensitive and better able to withstand remote storage. Further crew reductions came about as the USAF determined that ten armed launch facilities (LFs) could each be remotely manned from a single command center or missile alter facility (MAF). LFs surrounded their MAF, with each LF positioned at least three miles from adjacent LFs for survivability. A MAF was able to continually monitor the operational status and security of its ten LF as well as initiate missile launch via an underground cable system, called the Hardened Intersite Cable System (HICS). The four MAF/LF instillations of a squadron were also interconnected by HICS, enabling the monitoring and control all 50 of the squadron's missiles from a single facility.

Minuteman I MAFs had the surface appearance of a dwelling but this represented only a portion of the facility. Buried beneath under this topside building was a second structure and the true heart of the facility where the missile control equipment, support systems and crews were housed. This manned control center was of heavily hardened construction as to survive all but a direct strike in the event of nuclear attack. The topside portion accommodated living quarters and amenities for missile control crew and other personnel stationed at the MAF. It was not hardened but rather a soft structure, not designed to survive a nuclear blast.

Recognizing the need to maximize protection of its missile control equipment and personnel, the USAF modified the structural design of the MAF by the time that construction started on the Minuteman II program in the mid-1960s. The approach of soft living quarters over hard missile control equipment continued. A second buried, hard structure, however, was added. Known as the launch control support building (LCSB), it

was to contain equipment in support of MAF operations as well as equipment and other amenities necessary to sustain a livable environment for MAF personnel for two weeks. The USAF bolstered the durability of the LSSB with stock insulators and platform designed to absorb the electromagnetic pulses or tremors resulting from the spread of nuclear radiation.

In the early to mid-1970s, the transition to Minuteman III missiles resulted in several updates to internal operating systems of the MAF. These largely came in response to the introduction of the Multiple Independent Reentry Vehicle (MIRV). Refurbishing of a Minuteman II MAF to a Minuteman III, however did not require major modification of the either the above or below ground infrastructure.

New technologies continued to be incorporated in the Minuteman III. The most of significant of these was the REACT system, considered the most advanced command and control system upgrade in the history of the Minuteman missile. It was a state of the art upgrade that occurred in 1996 at the cost of $650 million.[1] The REACT system cut the retargeting time in half. The previous command and control system, the Command Data Buffer, required approximately 20 hours to retarget the entire Minuteman force and approximately two hours to retarget an individual element. The REACT system reduced retargeting the entire Minuteman force to 10 hours and individual elements to a matter of mere minutes.[2] Minuteman II squadrons had REACT-A systems and Minuteman IIIs REACT-B system. REACT-A system ran solely through the hardened intersite cable system while REACT-B systems utilized the HICS as well as radio signals.

In 2006, US defense leaders and the Quadrennial Defense Review decided to deactivate the 564th MS because the 564th MS operated with the REACT-B system while the MAFB's other missile squadrons operated with the REACT-A system. The cost of operating and training for a separate control and command system was approximately $10 million more a year in defense spending. The deactivation of the 564th MS meant the removal of the missiles and missile components from the MAFs and LFs, which began on 12 July 2007 when the first missile was removed from a Sierra LF. The USAF planned to remove one missile per week for the remainder of 2007, but the final missile was removed in July 2008. The 564th MS was officially deactivated on 15 August 2008. The Papa MAF was still in operation when documentation of the facility occurred, but was not on alert status. No major changes had occurred at the facility, and it operated as though on alert status with full security procedures.

Papa MAF Building Description

The Papa MAF is an excellent representative example of a missile alert facility upgraded from a Minuteman II to a Minuteman III installation. The facility has very obvious elements to its make-up: the MAF, a paved parking/turnaround area, a helicopter pad outside the fenced facility, protective fencing, a sewage lagoon, and above and below

[1] John Pike, "Rapid Execution and Combat Targeting," 2008.
[2] Ibid.

ground antenna and cables. The MAF is a nondescript building of which a part is 47 feet below ground. Only a facility name and warning signs indicate the military function of this facility.

The MAF is simple, L-shaped Ranch Style building. It has primary components: an above ground portion that houses the support functions of the facility and the below ground portion that houses the launch technology.[3] The above ground portion is known as the Launch Control Support Building (LCSB) while the below ground portion is the Launch Control Center (LCC). The LCSB is considered a "soft" building because it cannot survive a nuclear attack, unlike the LCC, which is a "hard" building that was designed to withstand nuclear attack.

The front, or west, elevation of the LCSB faces away from the access road and is apparent by its access door to the entry vestibule. It has 12 modern replacement windows, five of which are sliding windows identifying the residential and equipment sections of the building, while the remaining seven are fixed windows identifying the Flight Security Control Center (FSCC). Five doors are located amidst the five sliding windows, three of which are double metal doors accessing exterior equipment rooms, and two of which are single metal doors accessing the interior of the building. The east, or rear, elevation contains 10 modern sliding windows. There is a small vent towards the gable. The north elevation has the least architectural detail with only a small vent in the gable. This elevation has no fenestration. The south elevation faces the access gate to the facility. This elevation has five fixed windows associated with the FSCC and four vehicle entry bays with garage doors. The fourth entry bay garage door has a single inset metal door cut into it.

Paved parking and a turnaround area surround the west and south elevations of the LCSB while a yard surrounds the north and east elevations. Within the yard are various antennas and a sewage lagoon. The purpose of the sewage lagoon is for treating waste material. The rationale for constructing a sewage lagoon, as compared to a septic tank, can be found in newsletters for former and current missileers.[4] Theories proposed include problems with shallow ground water at missile bases, which created problems with flooding; the dependability of the earlier MAF designs; the remoteness of the locations, which prevented routine maintenance of septic systems; and the inconvenience of emptying septic tanks.

The antennas include soft ICBM super-high frequency satellite terminal (ISST) antenna, hard high frequency (HF) receive antenna, very high frequency (VHF) antenna, soft ISST transmit antenna, hardened ultra high frequency (UHF) antenna, soft HF antenna, and hard HF transmit antenna.[5] The hard HF receive antenna was a multi-component antenna system comprised of a monopole attached to a reinforced concrete cylinder and

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[3] Ken Parsons, "341 CES/CEVC Minuteman Weapon Generalization Familiarization Handbook," (Malmstrom Air Force Base: Missile Engineering QA Office, 1997), 1-5.
[4] Association of Air Force Missileers, "Sewage Lagoons – Why?," 2007.
[5] Ibid.

five small ports. The cylinder measures 16 feet in diameter and was 37 feet underground. The five small ports each had a ballistically actuated steel monopole antenna. This system was used until the mid 1980s. The hardened UHF antenna provided radio communication between the LCC and the ten associated Papa LFs. It was easily recognizable because of its cast-steel partial cone structure covered by a conical white fiberglass structure situated on a 16 square feet reinforced concrete slab. The hard HF transmit antenna was a hardened underground antenna housed in a reinforced concrete cylinder that measured 21 feet in diameter. It was located 50 feet below ground. It has a telescoping radio antenna. The hard HF transmit antenna was used until the mid-1970s.

The LCSB divides into two distinct areas: the personnel support area and the equipment area.[6] The personnel support area is the domestic area of the building that provides living and entertainment areas for those stationed at the facility. Personnel include the facility manager, Missile Control Crew (MCC), security teams, and cooks.[7] The personnel support area is a utilitarian interior designed to provide controlled access to the building and residential and recreational space for the crew stationed at the MAF. There is a framed image paying tribute to the history of the 564th MS in the entrance foyer. The image reads:

> *"The nation which forgets its defenders will be itself forgotten." – Calvin Coolidge*
>
> *Welcome to Papa Missile Alert Facility*
>
> *The 564th Missile Squadron enjoys a time-honored tradition of excellence. Here at Papa, we honor those who came before us by remembering our brethren of the 564th Bombardment Squadron.*
>
> *Originally a B-24 squadron operating in the European theater during World War II, we pay tribute to our comrades in arms who secured our nation's freedom for future generations.*

The principal spaces in this portion of the building are the FSCC, the recreational area, the dining/kitchen area, bedrooms, and restrooms. The recreational area is separated into a pool table room and a TV room. The pool table room solely contains a pool table while the TV room is characterized by a sitting area, a TV, and bookshelves. An open window faces the dining room. The theme of the recreational area is unique to the Papa MAF and echoes the sentiment of the entrance image. Adorning the walls are approximately eight framed images paying tribute to the World War II heritage of the 564th MS. The theme of the recreational area is normally decided either by the facility manager or by consensus of personnel serving at the MAF. The theme of Papa MAF was chosen for its status as the showcase MAF of the five associated with the 564th MS.

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[6] Ibid.
[7] Ibid.

The FSCC is utilitarian in nature and is accessible at the front of the building from the entry vestibule. It is filled with monitoring equipment for the security of the facility as a whole but is not associated with the actual monitoring of the LFs. The FSCC is also the access point for the below ground portions of the MAF. It is manned 24 hours a day, seven days a week. Security teams monitor access to the facility, the "soft" portion of the building, and the LCC, including shift changes in the MCC. The FSCC is at the front of the MAF and is obvious from the outside due to its placement and the number of windows. The dining and kitchen areas are characterized by updated appliances and furniture. Like the recreational area, the theme of the MAF continues in the dining room and the furniture is utilitarian but comfortable. Down the hall from the dining/kitchen area and the recreational area there are eight bedrooms and two restrooms. The facility manager (and any important visitors) has his/her own bedroom while the remaining personnel share bedrooms. The bedrooms resemble college dormitory rooms with the basic necessities of bunk beds or single beds, chests of drawers, a closet, an acoustical tile ceiling, and fluorescent lighting. Each room has blackout curtains and sound insulation for the privacy of those personnel sleeping during the day. The bedrooms at the north end of the MAF on the east and west sides are separated by a linen closet. Papa MAF has two restrooms, one for male personnel and the other for female personnel. Originally only male personnel served at a MAF, but in the mid-1980s the USAF integrated MAF crews.[8]

The Equipment Area refers to the various rooms with non-personnel support functions. The garage stores maintenance equipment and has a generator room and a fitness room. These rooms, like the generator room and fitness room, are very utilitarian. They include a telephone equipment room, a water treatment room, a heating equipment room, a utility room, and a general equipment room. Only the utility room and the general equipment room are accessed from the interior of the MAF. The remaining equipment rooms are accessed from the exterior of the building.

The LCC is the "hard" portion of the building and is located beneath the LCSB. Two of the missile squadrons in the 341st MW have just the LCC while the other two missile squadrons, including the 564th MS, have a second "hard" building, the Launch Control Equipment Building (LCEB).[9] Consequently, Papa MAF has two capsules underground: the LCC and the LCEB.

The LCC is the command center for the LFs. It is a buried building constructed of reinforced concrete three to four feet thick with a ¼ inch steel plate that protects the MCC and launch equipment from nuclear attack. It is accessed through the FSCC via elevator, which is original to the building, or by a steel-rung ladder with a safety cage. Next to the elevator and ladder are the machine room and the elevator vestibule. The

[8] Christina Slattery et al., "Minuteman ICBM Launch Control Facility Delta 0-1 and Launch Facility Delta 0-9, Ellsworth Air Force Base National Register of Historic Places Nomination Form," http://www.nps.gov/archive/mimi/history/srs/hrsab.pdf, 2003.
[9] Parsons, 1-5.

elevator opens into a tunnel junction bearing an original mural on the wall. The mural is circular in shape and reads "Winners of the Cold War / The ICBM Deterrent Force. Inside the circle are four aces that reference the Atlas, Titan, Peacekeeper, and Minuteman missiles held behind a clenched Soviet flag. Above and below the images it reads "Aces in the Hole" and "Read Em and Weep."

Inside the capsule are the control panel, air conditioning (AC) unit, pneumatic shock isolators, bunk beds, escape hatch, power supply group, oxygen regeneration unit, command message processing group, telephone equipment, kitchen services group, and Air Force Satellite Communications System (AFSATCOM) group.[10] The floor of the LCC capsule is a suspended platform on the pneumatic shock isolators, which run the height of the capsule and stabilize the capsule after nuclear attack. The console has two control panels that monitor activities at the 10 LFs associated with Papa MAF (P-1 through P-10 LFs). The high-backed, aircraft seats in front of the console were designed as part of the capsule's resistance to the effects of a nuclear attack. Each seat has a shoulder harness and a seatbelt and both seats are on a track to facilitate movement. In a case of attack, these seats could be locked down into a stable position. The two-person crew that served in the LCC has specific functions: the commander monitors the launch control console while the deputy commander monitors the communications console.[11] There is another mural painted on the AC unit, which continues the playing card theme, although this mural references the 564th nickname of *Deuce*. This mural has five cards with "Deuces Wild" written above them. To the left of the cards reads "P-O LCC Malmstrom's 1st Deuce Capsule Accepted by Col. J. Carroll 18 Jan 67." Adjacent to the AC unit is a small bathroom. The walls of the capsule are also decorated with wallpaper in a beach theme and the names or initials, date, and occasionally pictures of crew who have served their last alert. An eight-ton blast door protects the LCC.

The LCEB, located in another capsule across a reinforced concrete tunnel junction, houses equipment necessary for the LCC to operate autonomously for up to six weeks, although the MAFs associated with the 546th MS currently can operate self-sufficiently for two weeks.[12] This equipment includes what is necessary to maintain the living environment within the capsule and the operational capabilities of the capsule and the launch equipment. A typical LCEB contains up to 41 pieces of equipment, including AC control panel, alarm control panel, diesel fuel day tank, telephone equipment, ventilation equipment (both air and diesel), control air compressor, water valves, fire alarm, shock isolator air compressors, battery charges panel, and generator control panel.[13] Two large pneumatic shock isolators run almost the height of the capsule. The floor is suspended from the ceiling on the shock isolators and sits approximately two feet from the side to

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[10] Parsons, 1-5.
[11] Slattery et al.
[12] Ken Parsons and Anthony Lucas, 341 CES/CEVC, Malmstrom Air Force Base, interview by Mathia Scherer, 16 October 2007.
[13] Parsons, 1-5.

allow movement to stabilize the equipment to control against impact from possible nuclear attack. An eight-ton blast door protects the LCEB.

The crews chosen for the MCC were originally hand-picked from volunteers and many already had degrees in engineering. These men underwent extensive psychological examination to ensure their mental stability in order to launch a wartime nuclear missile. Initially, a two-man crew spent 48 hours in the LCC, although today both men and women serve on the MCC and serve 24-hour shifts. MCC shifts have alternated in the past two decades between 24-hour and 36-hour shifts, depending upon the national defense budget and the demands of the technology associated with the command and control system.

The US government established various safeguards to prevent the unauthorized launch of a nuclear missile. The President initiates launching by ordering Space Command (formerly the SAC) to strike, with the orders verified by code. The MCC crew inserts their two keys, which signals another MCC crew at another MAF to insert their launch keys. A third MCC is alerted, allowing for a very short lag time to halt the launch if necessary. Once the President gives the orders, and pending no cessation of the process, a Minuteman launch can occur within one minute.

ACRONYMS

AC	Air Conditioning
AFSATCOM	Air Force Satellite Communications System
CDB	Command Data Buffer
FSCC	Flight Security Control Center
HF	High Frequency
HICS	Hardened Intersite Cable System
ICBM	Intercontinental Ballistic Missile
ISST	ICBM Super-High Frequency Satellite Terminal
LCC	Launch Control Center
LCEB	Launch Control Equipment Building
LCSB	Launch Control Support Building
LF	Launch Facility
MAF	Missile Alert Facility
MAFB	Malmstrom Air Force Base
MCC	Missile Control Crew
MS	Missile Squadron
MW	Missile Wing
REACT	Rapid Execution and Combat Targeting
REACT-B	Rapid Execution and Combat Targeting-B System
SR	State Route
UHF	Ultra-High Frequency
USAF	United States Air Force
VHF	Very High Frequency

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